In the Claims:

Claim 1 (withdrawn). A trench capacitor, comprising:

a substrate having a trench formed therein, said substrate having a substrate surface and said trench having an upper region and a lower region;

an insulation collar formed in said upper region of said trench;

a dielectric layer lining said lower region of said trench and said insulation collar as a capacitor dielectric;

a conductive filling material filled in said trench and serving as a capacitor plate;

a buried contact beneath said surface of said substrate; and

a doped region below said substrate surface in a vicinity of said buried contact, said doped region having dopants introduced by at least one of an implantation doping, a plasma doping, and a vapor phase deposition.

Claim 2 (withdrawn). The trench capacitor according to claim 1, comprising a buried plate in said substrate in a vicinity of said lower region of said trench as a further capacitor plate.

Claim 3 (withdrawn). The trench capacitor according to claim 1, comprising a strap on said filling material above said insulation collar, said strap formed of a further filling material.

Claim 4 (withdrawn). The trench capacitor according to claim 1, wherein said trench is a bottle-shaped trench having a widened region with a cavity formed in said conductive filling material.

Claim 5 (withdrawn). The trench capacitor according to claim 1, wherein said conductive filling material above said insulation collar forms a strap to said buried contact with said substrate.

Claim 6 (withdrawn). The trench capacitor according to claim 1, wherein said buried contact has an interface, and including a tunnel layer at said interface.

Claim 7 (withdrawn). The trench capacitor according to claim 6, wherein said tunnel layer is selected from the group consisting of an oxide layer, a nitride layer, and an oxinitride layer.

Claim 8 (currently amended). A method for producing a trench capacitor, which comprises the following steps:

providing a substrate;

forming a trench with a lower region and an upper region in the substrate;

filling the lower region of the trench with a first filling material;

forming an insulation collar in the upper region of the trench;

removing the first filling material from the lower region of the trench;

lining the lower region of the trench and an inner side of the insulation collar with a dielectric layer as a capacitor dielectric;

filling the trench with a conductive second filling material as a capacitor plate;

providing a buried contact region for said capacitor plate underneath a surface of said substrate; and

forming a doped region in said buried contact region by introducing a dopant into the substrate in a region underneath a surface of the substrate by at least one process selected

from the group consisting of implantation, plasma doping, and vapor phase deposition without requiring out-diffusing.

Claim 9 (original). The method according to claim 8, which comprises forming a buried plate in a vicinity of the lower region of the trench as a further capacitor plate.

Claim 10 (previously amended). The method according to claim 8, wherein the step of introducing a dopant includes one of an oblique doping and an isotropic doping through an uncovered interface of the buried contact region.

Claim 11 (previously amended). The method according to claim 8, wherein the step of introducing a dopant includes one of an oblique doping and an isotropic doping through a screen oxide on an interface of the buried contact region.

Claim 12 (previously amended). The method according to claim 8, which comprises forming a tunnel layer on an interface of the buried contact region.

Claim 13 (original). The method according to claim 12, wherein the step of forming a tunnel layer includes forming one of an oxide layer, a nitride layer, and a oxinitride layer.

Claim 14 (previously amended). The method according to claim 8, wherein the step of introducing a dopant includes vapor phase doping through an exposed interface of the buried contact region with one of AsH_3 and PH_3 at 1100°C, 1 min, and 760 Torr.

Claim 15 (cancelled).

Claim 16 (previously amended). The method according to claim 8, which comprises:

filling the trench with a fourth filling material being selectively removable with respect to the substrate, the insulation collar, and the dielectric layer, after the steps of forming the insulation collar and lining the lower region of the trench and the inner side of the insulation collar with a dielectric layer;

recessing the fourth filling material, the insulation collar, and the dielectric layer for defining an interface between the buried contact region and the substrate;

removing the fourth filling material; and

filling the trench with the conductive second filling material.

Claim 17 (original). The method according to claim 8, which comprises widening the lower region of the trench relative to the upper region of the trench for forming a bottle shaped trench.

Claim 18 (original). The method according to claim 12, which comprises forming a buried strap in the trench.

Claim 19 (previously amended). The method according to claim 12, which comprises loading the substrate in a process chamber and performing the steps of providing the buried contact region and forming the tunnel layer in a single process sequence without removing the substrate from the process chamber.

Claim 20 (previously amended). The method according to claim 18, which comprises loading the substrate in a process chamber and performing the steps of providing the buried contact region, forming the tunnel layer, and forming the buried strap in a single process sequence without removing the substrate from the process chamber.

Claim 21 (withdrawn). A memory element, comprising:

a trench capacitor including a substrate having a trench formed therein, said substrate having a substrate surface and

said trench having an upper region and a lower region, an insulation collar formed in said upper region of said trench, a dielectric layer lining said lower region of said trench and said insulation collar as a capacitor dielectric, a conductive filling material filled in said trench and serving as a capacitor plate, a buried contact beneath said surface of said substrate, and a doped region below said substrate surface in a vicinity of said buried contact, said doped region having dopants introduced by at least one of an implantation doping, a plasma doping, and a vapor phase deposition; and

a selection transistor connected to said trench capacitor via said buried contact.